

Skin and Mucosal Delivery II

NESTERKINA MARIIA

ADVANCES IN CONTROLLED TRANSDERMAL
DELIVERY OF ANTITUBERCULAR DRUGS



Concept of investigation



Liquid
crystals
Stimuli

Temperature



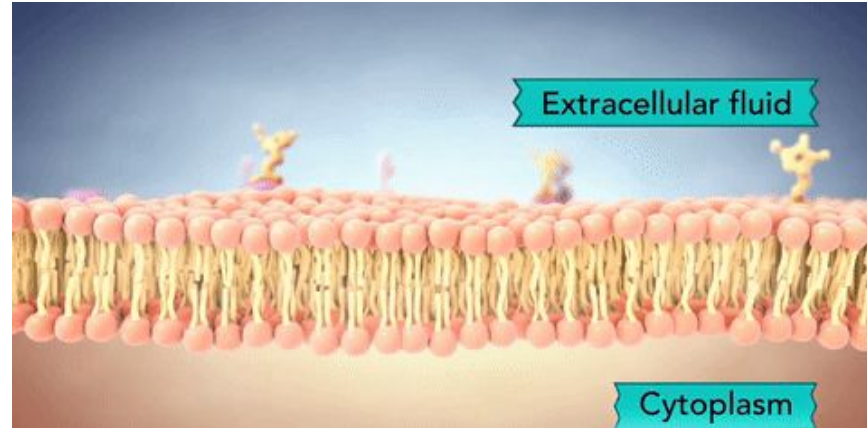
Light



Magnetic field

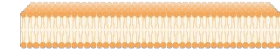


Electric field



Nucleus Medical Media Inc.

Liquid-crystalline nature of the lipid
bilayer



Phospholipids form a smectic A phase



SmA

Liquid crystals

Lyotropic

hydrophobic
non-polar tail



- Phase transition depends on temperature and concentration

Thermotropic

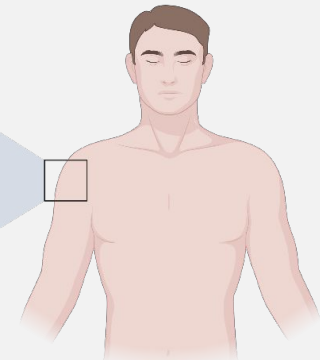
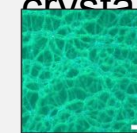
flexible tail



- Phase transition depends on temperature

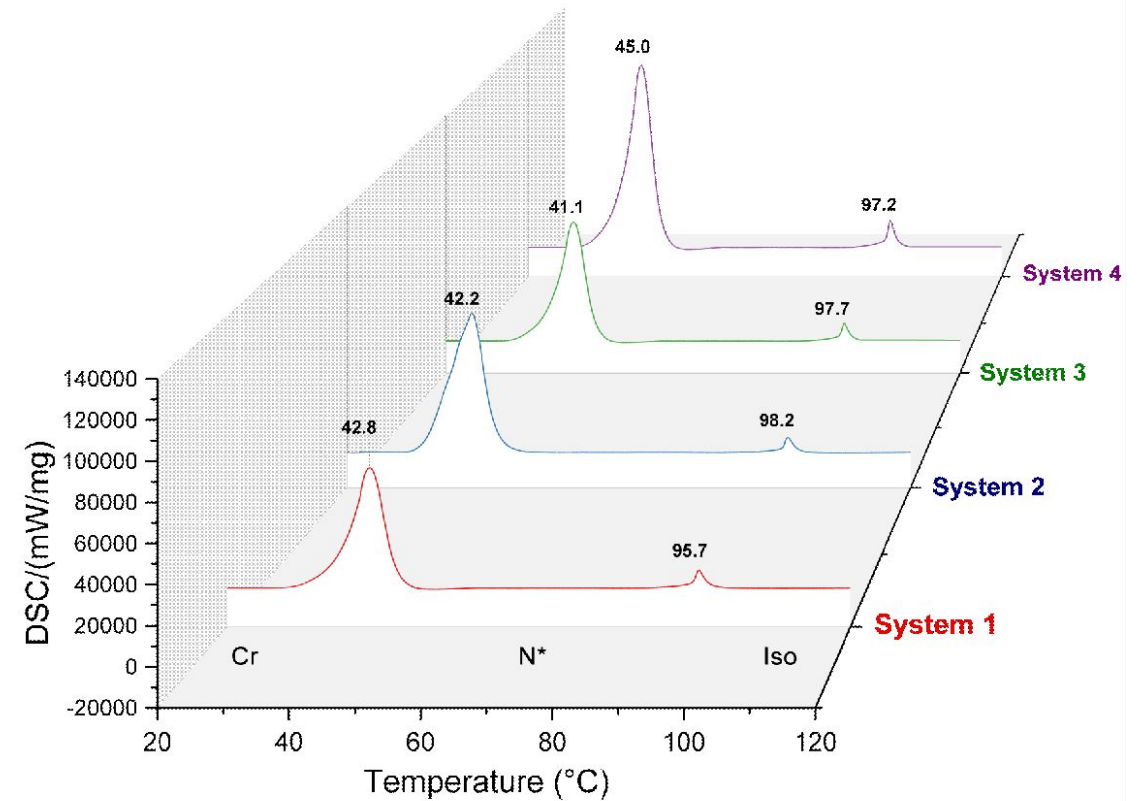
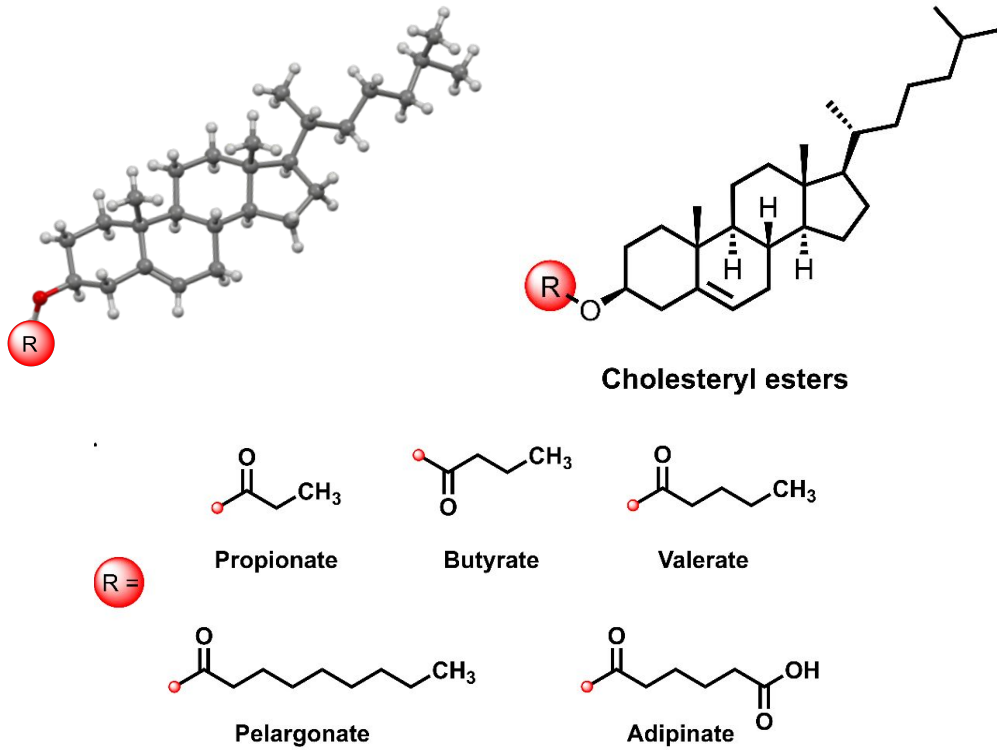
Strategy

Liquid
crystals



Thermotropic liquid crystals for skin
drug delivery

Thermotropic liquid crystal systems based on cholesteryl esters



System 1

- Cholesteryl pelargonate (50%)
- Cholesteryl valerate (25%)
- Cholesteryl butyrate (25%)

System 2

- Cholesteryl pelargonate (50%)
- Cholesteryl propionate (25%)
- Cholesteryl butyrate (25%)

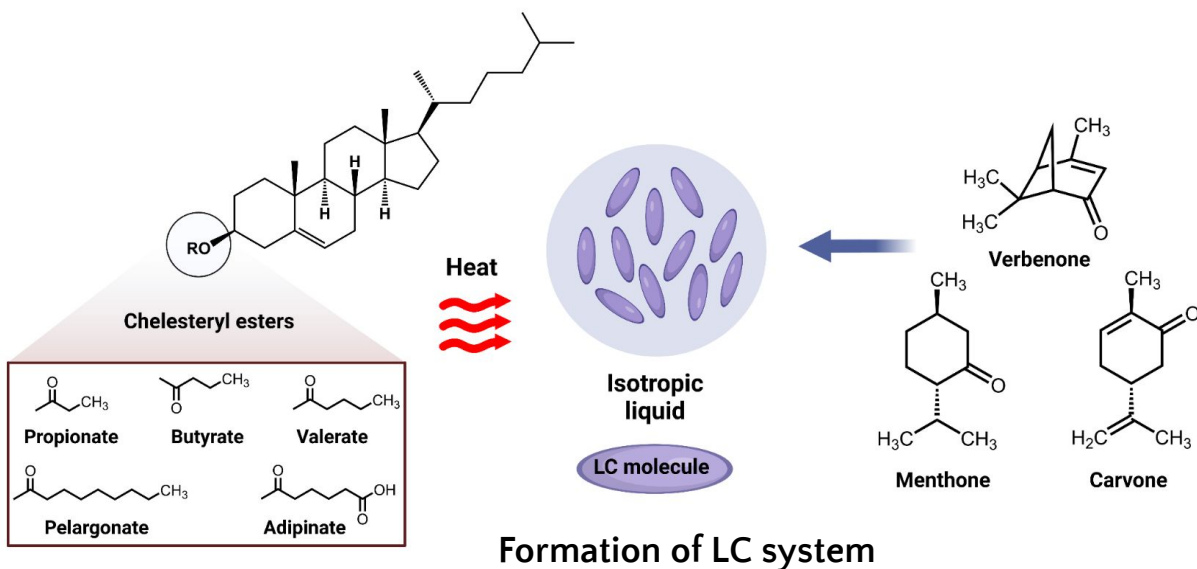
System 3

- Cholesteryl pelargonate (50%)
- Cholesteryl adipate (25%)
- Cholesteryl butyrate (25%)

System 4

- Cholesteryl pelargonate (50%)
- Cholesteryl adipate (25%)
- Cholesteryl propionate (25%)

Optimisation of cholesteric liquid crystal systems



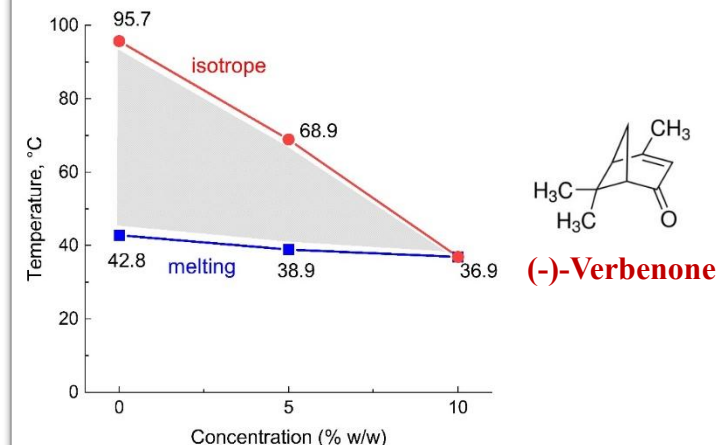
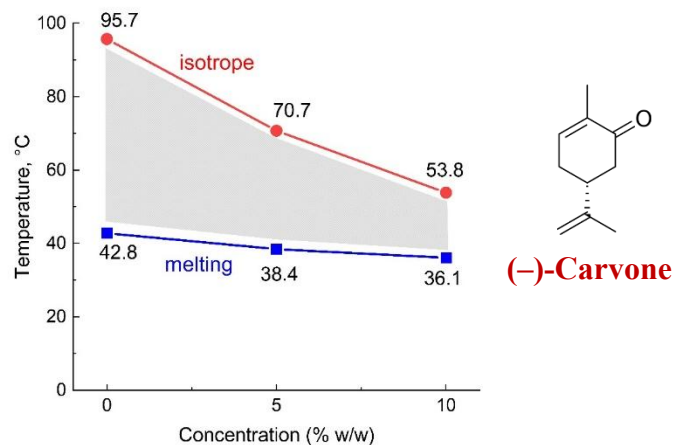
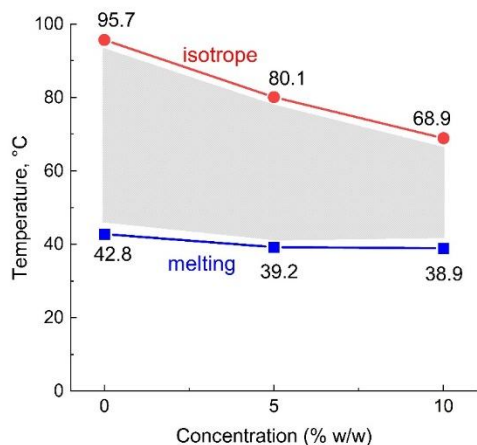
Liquid crystal system 1

- Cholesteryl pelargonate (50%)
- Cholesteryl valerate (25%) Cholesteryl butyrate (25%)

Temperatures of phase transitions:

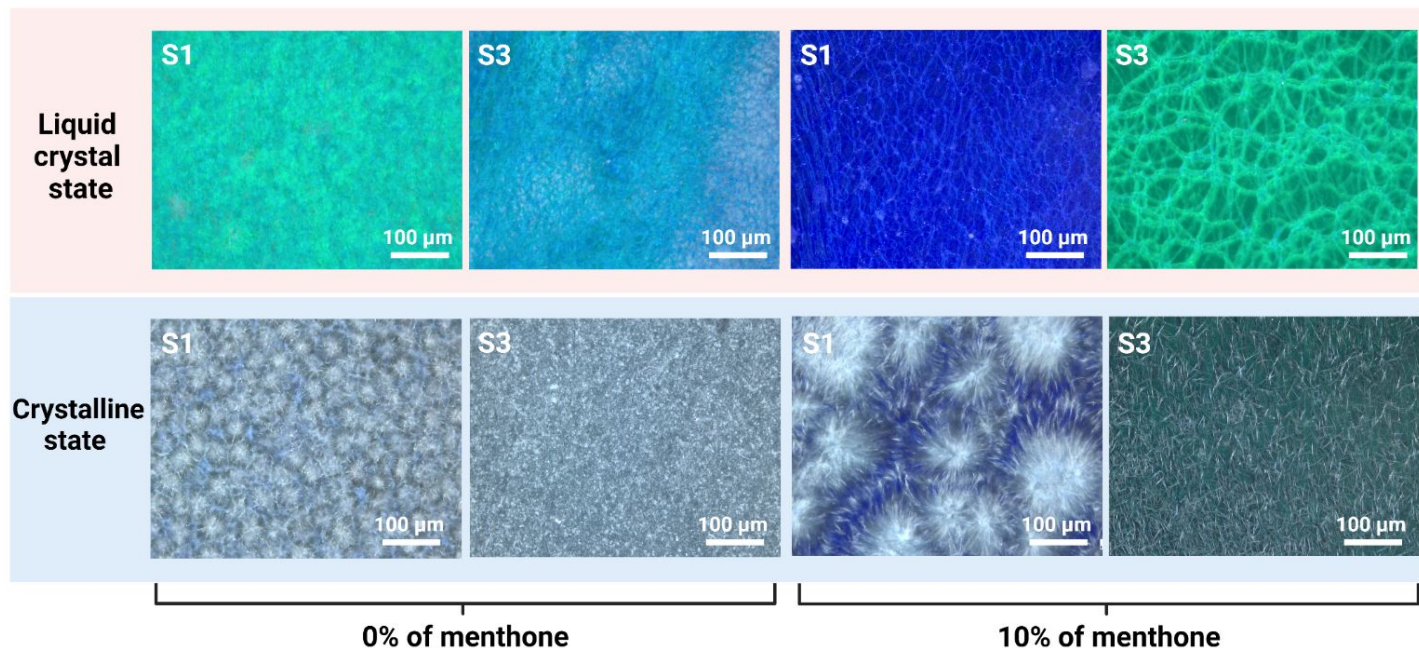
“crystal – liquid crystal” (— squares)

“liquid crystal – isotropic liquid” (— circles)



Liquid crystal state

Polarizing optical microscopic observation of phase transitions



System 1

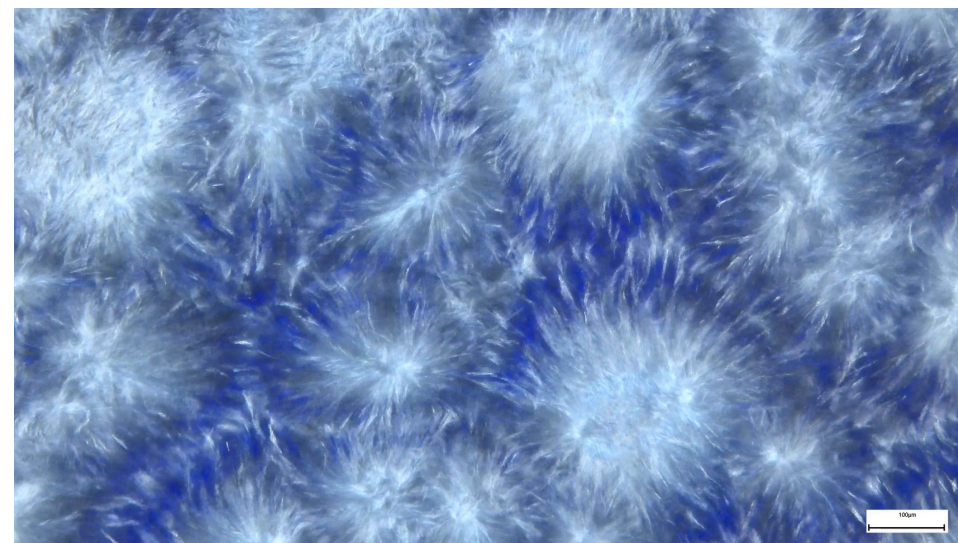
- Cholesteryl pelargonate (50%)
- Cholesteryl valerate (25%)
- Cholesteryl butyrate (25%)

CC1(C)C(=O)CC(C)C1

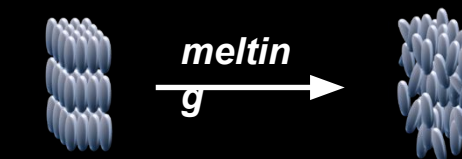
(-)-Menthone

System 3

- Cholesteryl pelargonate (50%)
- Cholesteryl adipate (25%)
- Cholesteryl butyrate (25%)



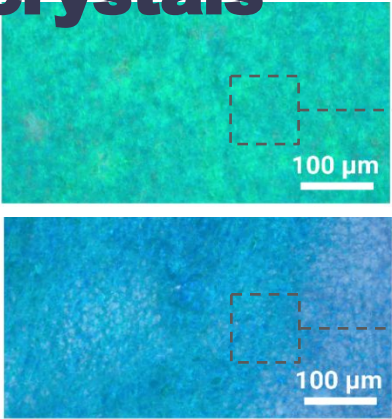
Phase transition of liquid crystals on the surface such as skin



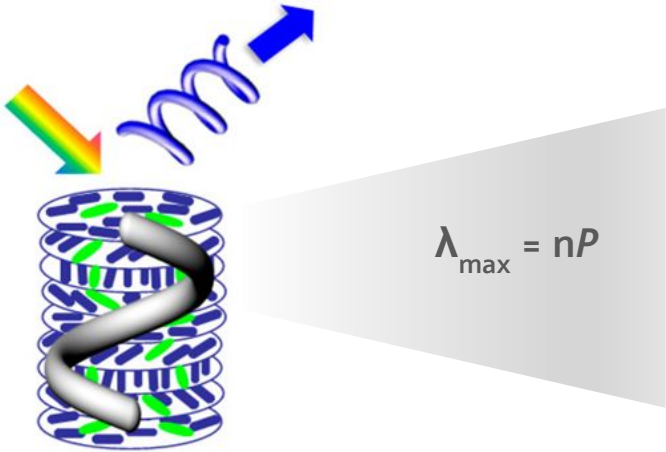
System 1 with 10% of menthone



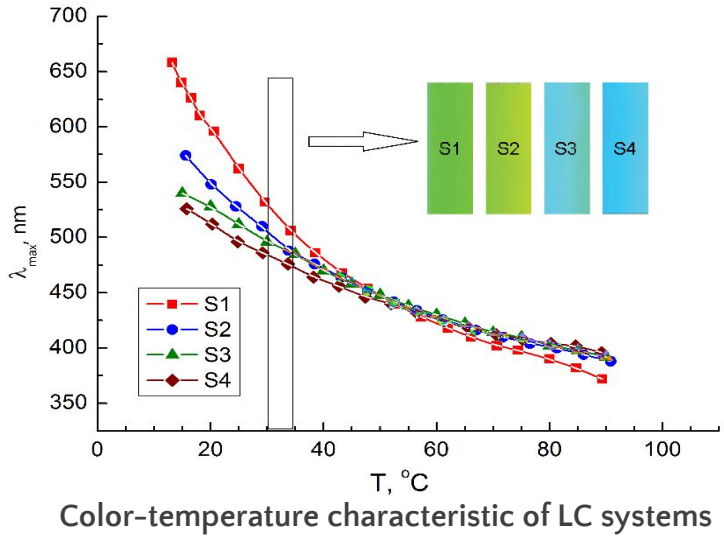
Composition-dependent pitch variability in cholesteric liquid crystals



Optical polarizing microscope textures



Selective reflection

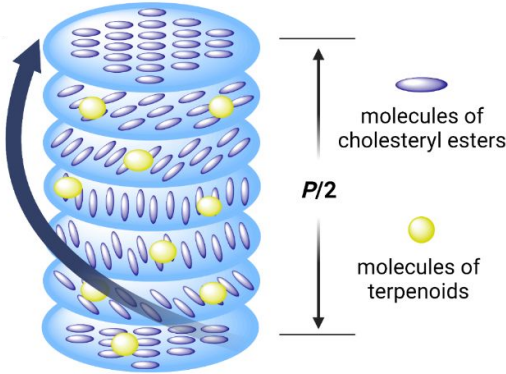


Color-temperature characteristic of LC systems



Phase transition on the skin surface

- ☐ The helical pitch 410–450 nm corresponding to ■ 'violet to blue' color.
- ☐ The helical pitch 490–570 nm corresponding to ■ 'blue to green' color of the system.

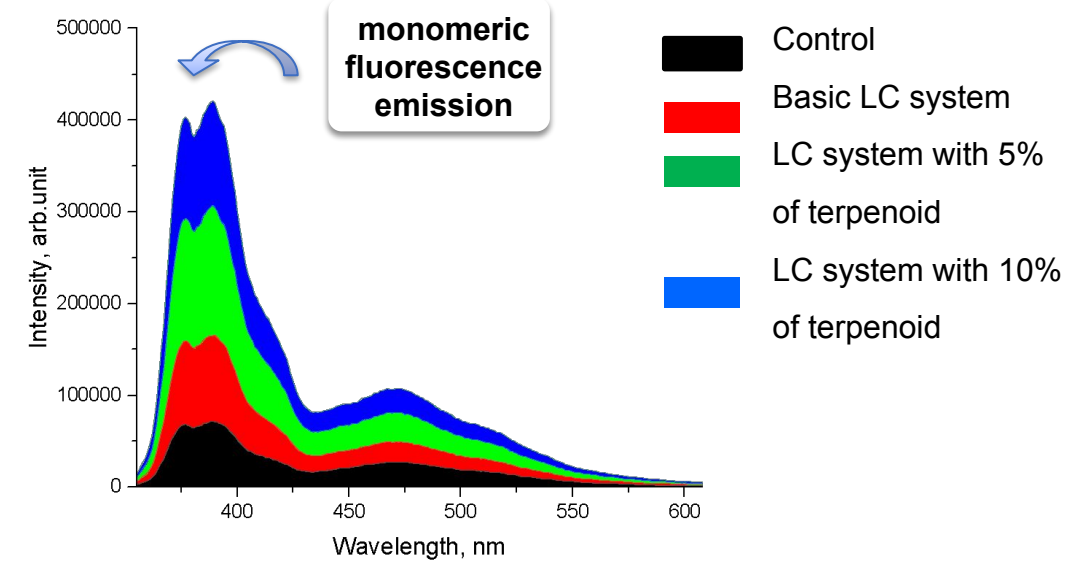
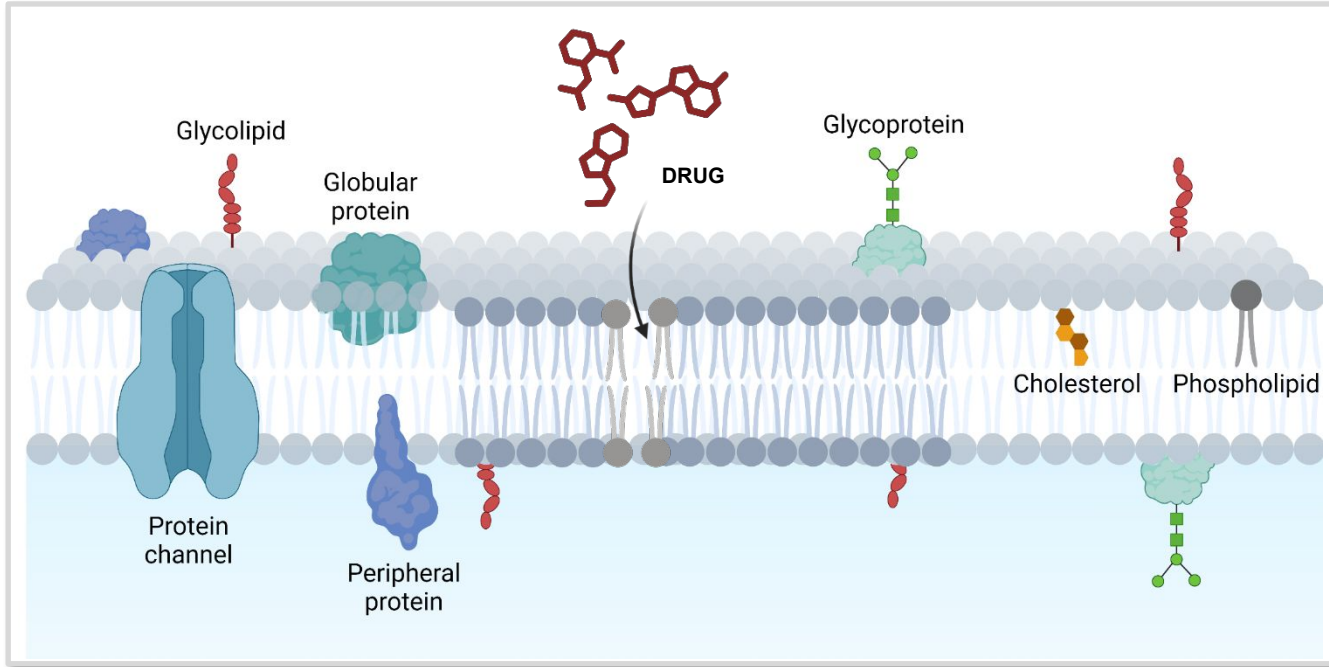
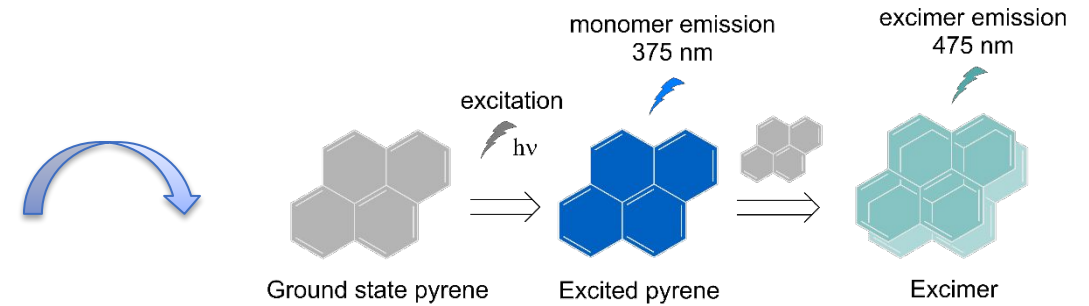
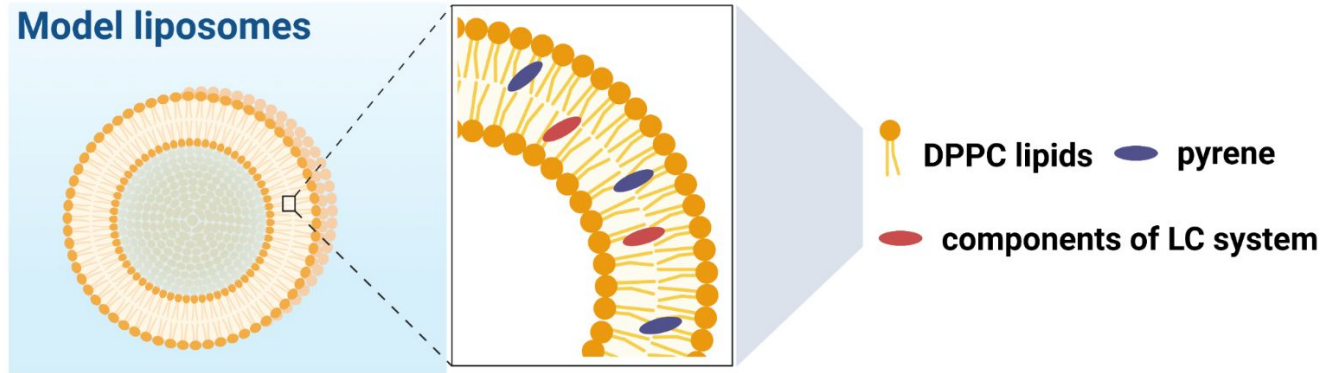


Helical pitch



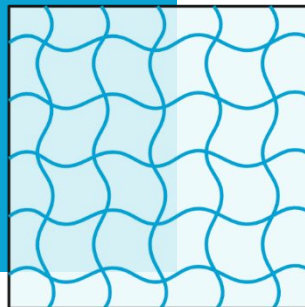
The impact of liquid crystals on biological membrane structure

Model liposomes

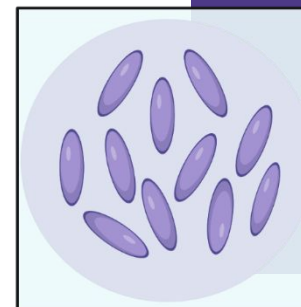


Polymer-dispersed liquid crystal films for skin drug delivery

- Sodium alginate
- Hyaluronic acid
- Glycerol
- Water

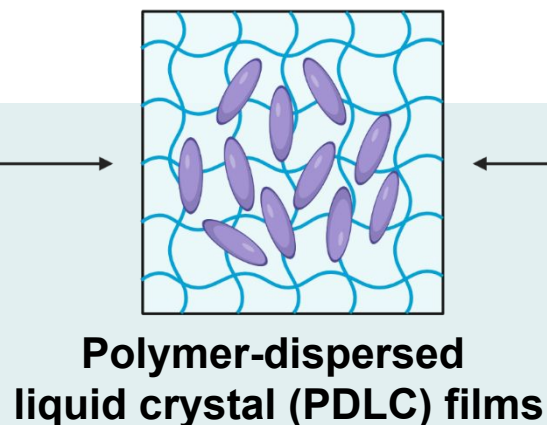


Polymer matrix

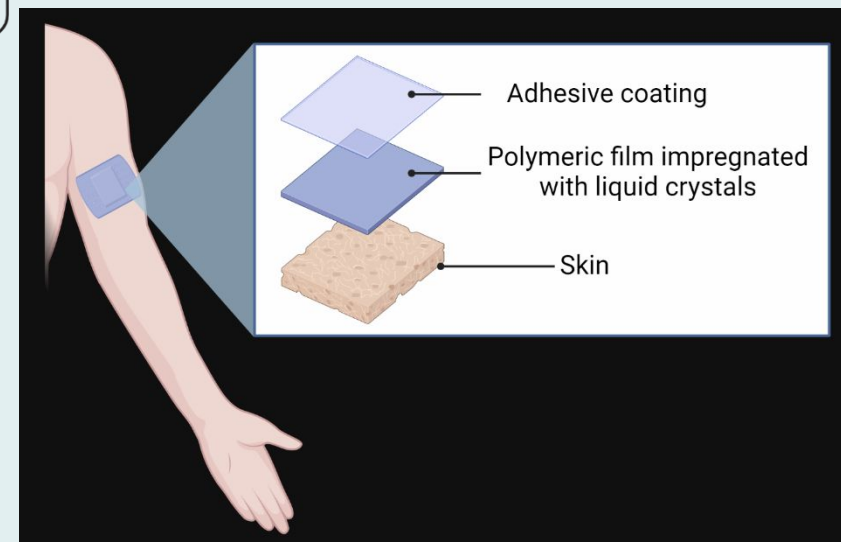
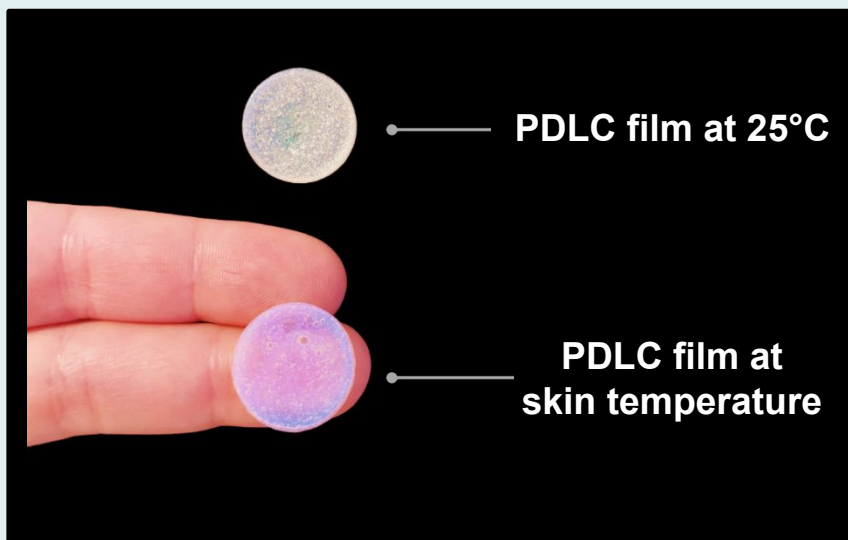


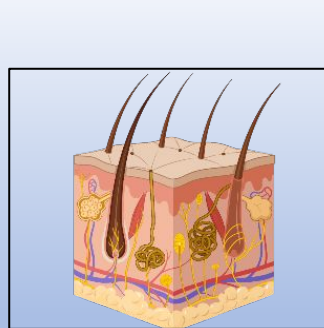
Liquid crystal system

- Cholesteryl pelargonate
- Cholesteryl valerate
- Cholesteryl butyrate
- Menthone

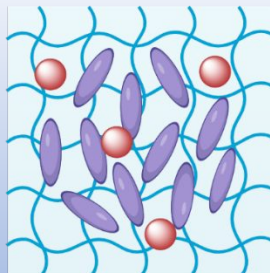
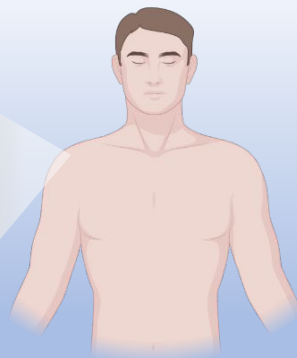


Polymer-dispersed liquid crystal (PDLC) films

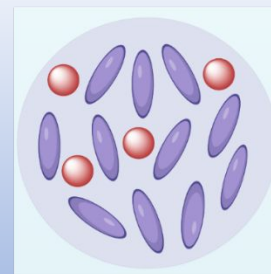




Full human skin



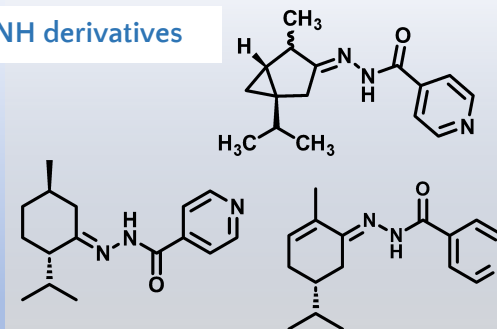
Polymeric matrix



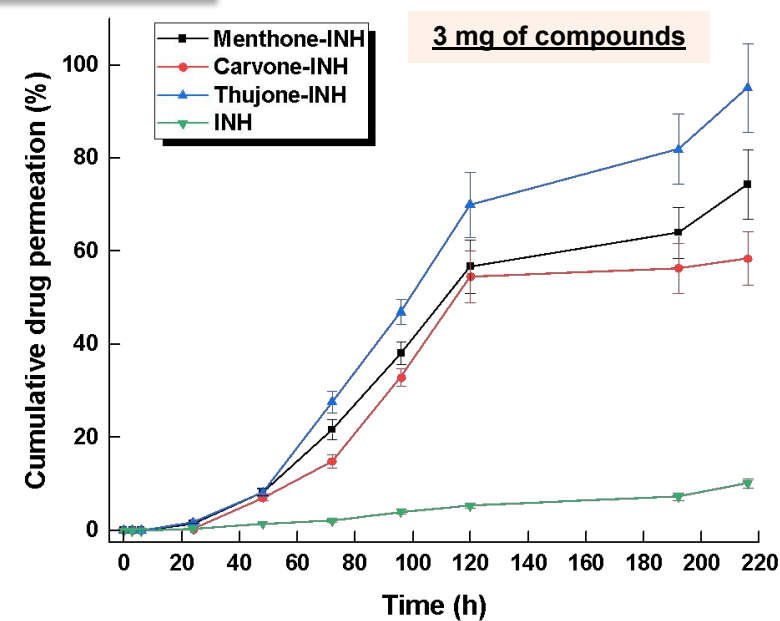
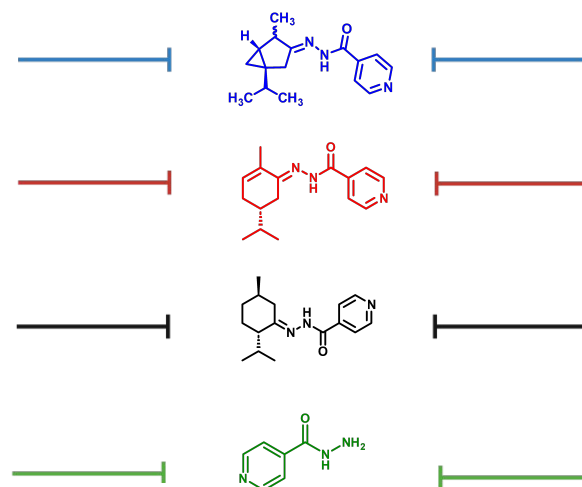
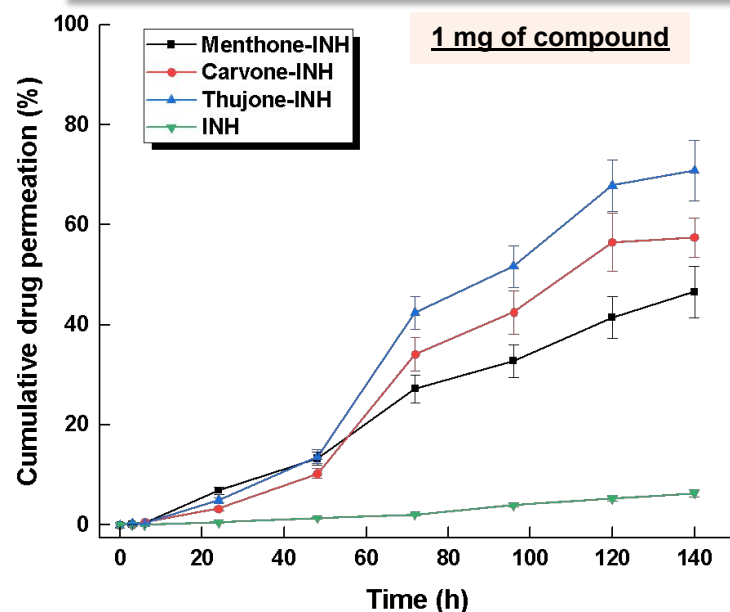
Liquid crystals with INH derivatives



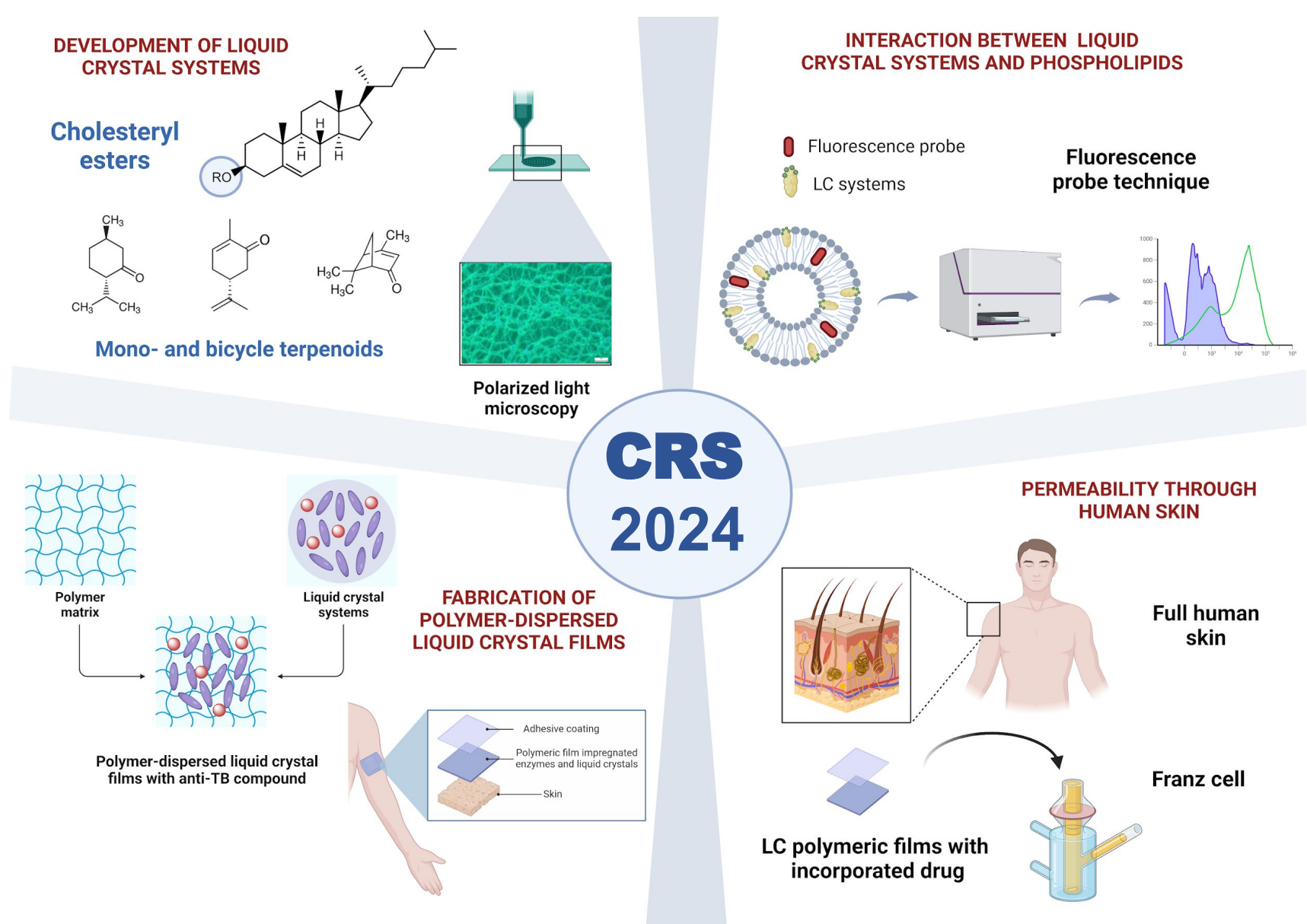
INH derivatives



Cumulative amount of isoniazid (INH) derivatives penetrated through the full human skin



Summary



Acknowledgment

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